Statement of Mr. John B. Howe
Vice President, Public Affairs, Verenium Corporation
Before the Committee on Small Business
United States House of Representatives
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Madame Chairman and members of the Committee, good afternoon. My name is John B. Howe, Vice President, Public Affairs for Verenium Corporation. We are a leading developer of advanced biofuels process technology and commercial projects, headquartered in Cambridge, Massachusetts. I greatly appreciate the opportunity to speak with you in this hearing on challenges facing the renewable fuels industry. This is a truly critical topic and a most critical time for this discussion.

Among America's biggest challenges is the need to expand domestic energy resources and curb our appetite for imported fuels. Over the past few years, we have all seen how our dependence on foreign supplies has drastically weakened our nation's economy. And we must recognize that, just as US oil production peaked forty years ago, we are year by year moving toward a global peak or plateau in conventional oil production. Finally, we are coming to grips with the need for dramatic action to curb carbon emissions and forestall climate change. Advanced biofuels, which are low-carbon, renewable and domestically available, can help us to address all of these major challenges. In recent years they have become not simply a nice-to-have option, but truly a must-have solution. The temporary, drastic fall in world oil prices brought on by the economic downturn does not alter our longer-term predicament. Major changes to our capital-intensive liquid fuels infrastructure will take years to implement. If we expect advanced biofuels to be a scalable, truly impactful part of the energy solution within the next decade, there is literally no time to lose.

The Small Business Committee has a special stake in this issue because a domestic US advanced biofuels industry will be a major driver for growing small businesses nationwide. Such an industry will rely on small-scale, geographically dispersed production. It will use a variety of agricultural feedstocks and innovative, regionally-adapted technological processes. It will generate a wealth of high-quality, non-exportable jobs in small businesses throughout the nation. This is shown clearly by a map appended to my statement with the locations of currently active advanced biofuels projects nationwide.

The good news is that the emerging advanced biofuels industry is making strong technical progress, belying the cynic's barb that advanced biofuels are "always a decade away." Last month, Verenium successfully commissioned one of the nation's first true demonstration-scale cellulose-to-ethanol plants, a privately-financed, $80 million, 1.4 million gallon facility in Jennings, LA that generated 300 construction jobs and has 70 permanent employees. In January, we announced our plans to participate in a 36 million gallon commercial-scale facility, to be built in south central Florida, that will generate 400 construction jobs, 140 permanent jobs and a host of spinoff jobs in the local community. The expanded RFS targets established by Congress in 2007 may appear ambitious. But our nation can reach these targets if we stand by this commitment, and work together to develop a strong, clear, comprehensive and consistent policy framework that supports it. Given the effects we saw last year from skyrocketing costs for energy imports, I believe it could be much costlier in the long run not to stand by this commitment. Truly, this is a case where destiny is in our own hands.

There are, however, several obstacles to the successful development of a domestic advanced biofuels industry. Most crucial are financing challenges even more severe than those in the economy at large. At present, large, well-established companies selling standard products are facing tight credit. But even in the best of times, private lenders are unwilling to take technology risk on energy projects using new technologies. So finding private capital to commercialize new biofuels technology is virtually impossible

under present conditions. The result is a financing logjam. The nation will need first-of-a-kind, commercial-scale projects. This is the only way to establish a track record for new technologies. Once these first steps are taken, private capital will be able to step and fund the buildout of the industry. To take this first step and break this logjam, there is essentially no other place to go today except for government loans, grants and loan guarantees.

These financing challenges, and the challenges inherent in developing new technologies, are only part of the story. Advanced biofuels developers are also hard at work with partners in the agricultural sector, establishing new and fairly complex supply chains for the planting, production, harvest and collection of new feedstocks. Downstream in offtake markets are other risks. Policymakers have yet to clarify how the rapidly expanded production of biofuels mandated by the RFS will be absorbed in a market in which EPA regulations act as a quota, limiting the blending of ethanol in gasoline to 10%. Finally, the global fuels market itself is famously subject to the influence of strategic behavior by large and powerful actors. Several statements from the leadership of the OPEC cartel in recent years suggest a goal to prevent biofuels from becoming established as an alternative fuel source. We have our work cut out for us!

Despite all of these obstacles, the important thing to remember is that the advanced biofuels industry holds tremendous long-term potential for our nation – to help renew our economy, to create jobs, to restore natural balance in our fragile environment, and to enhance domestic energy security. A recent report prepared for GM by Sandia National Laboratory supports this perspective. Sandia found that a large-scale cellulosic ethanol industry, capable of meeting one-third to one-half of America's liquid fuel needs from within a comparatively modest physical footprint, is both feasible and affordable. Appended to my statement is a summary and list of recommendations from this report. The key to success, Sandia found, is a sustained, consistent policy commitment. A half-hearted approach will not do. We simply do not have the option <u>not</u> to pursue advanced biofuels. Instead, we need to focus on how to do it right, through careful attention to the right feedstocks and processes.

Let me close by observing that today's economic crisis arose from many complex forces. But there is strong evidence that the surge in world oil prices, combined with our excessive dependence on oil imports, was the precipitating event. We all want to know when the nation will emerge from today's economic weakness. Given the realities of the 21st century, if our nation is to achieve a truly sustainable, long-term recovery, we simply must have commercially viable, scalable and environmentally sustainable technologies for the domestic production of liquid fuels. Granted, the challenges we face in meeting this goal are severe. But failure is not an option.

This concludes my testimony. Thank you very much for the invitation to participate in today's hearing.

Existing and Planned U.S. Cellulosic Biofuel Biorefineries

Bio
BIOTECHNOLOGY
INDUSTRY ORGANIZATION

90-Billion Gallon Biofuel Deployment Study

Executive Summary

Sandia National Laboratories and General Motors' R&D Center conducted a joint biofuels systems analysis project from March to November 2008. Known as the "*90-Billion Gallon Biofuel Deployment Study*," the purpose of the project was to assess the feasibility, implications, limitations, and enablers of large-scale production of biofuels in the United States.

Ninety billion gallons of ethanol (the energy equivalent of approximately 60 billion gallons of gasoline) per year by 2030 was chosen as the book-end target to understand the requirements of an aggressive biofuels deployment schedule. Since previous studies have addressed the biomass supply potential, but not the supply chain rollout needed to achieve large biofuels production targets, the focus of this study was to develop a comprehensive systems understanding of the evolution of the complete biofuels supply chain and key interdependencies over time.

The biofuels supply chain components examined in this study included direct agricultural land use changes, production of biomass feedstocks, storage and transportation of these feedstocks, construction of conversion plants, conversion of feedstocks to ethanol at these plants, transportation of ethanol and blending with gasoline, and distribution to retail outlets. To support this analysis, a 'Seed to Station' system dynamics model (Biofuels Deployment Model – BDM) was developed to explore the feasibility of meeting specified ethanol production targets. System dynamics was chosen as the primary modeling approach because it is well suited to dynamic, non-linear problems involving time-varying inputs and feedback – two central features of the biofuels enterprise.

Potential biofuels supply chain barriers examined in this study included impact on land availability and use; impact on water consumption; the transportation and distribution infrastructure challenges and bottlenecks; costs for feedstock, capital, and energy; the reluctance to make long-term investments due to risk; the pace of technological innovation; and the greenhouse gas footprint. Sensitivity analyses were conducted to determine key parameters affecting production volumes, cost, and greenhouse gas savings. The effectiveness and costs of selected policy options to mitigate potential barriers were also examined.

Study Conclusions

This study concludes that 90 billion gallons per year of biomass-derived ethanol can be produced and distributed with enduring government commitment and continued technological progress. Specifically, the model projects that 90 billion gallons of ethanol can be produced per year in the U.S.: 15 billion gallons per year from corn ethanol, with the balance from cellulosic ethanol.

In the study we also evaluated a scenario with 15 billion gallons of corn-derived ethanol and 21 billion gallons of cellulosic ethanol by 2022, an amount that meets the Energy Independence and Security Act advanced biofuels mandate. In this scenario, cellulosic ethanol continues to ramp up to 45 billion gallons per year by 2030, for a total ethanol production of 60 billion gallons per year. This scenario is the basis for the conclusions summarized below.

Producing 45 billion gallons per year cellulosic ethanol by 2030 requires 480 million tons of biomass, of which 215 million tons comes from dedicated energy crops. Allowing for storage, loss, and immature perennial crops, these energy crops utilize 48 million acres of planted cropland from what is now idle, pasture, or non-grazed forest. The simulations assume technological progress in the conversion technologies, which results in average biomass conversion yields of over 95 gallons of ethanol per dry ton of biomass by 2030.

Biofuels capital expenditures necessary to achieve 60 billion gallons per year of installed production capacity are on the order of $250 billion. Though large, these expenditures are actually of similar magnitude to petroleum-related investments required to establish and maintain 40 billion gallons per year of domestic oil production. However, large capital investments are challenging considering the present volatility of the oil and capital markets and the amount of regulatory risk.

This study demonstrates that cellulosic biofuels can compete with oil at $90/bbl based on the following assumptions:

1) Average conversion yield of 95 gallons per dry ton of biomass
2) Average conversion plant capital expenditure of $3.50 per installed gallon of nameplate capacity
3) Average farm-gate feedstock cost of $40 per dry ton

Sensitivity analyses varying these assumptions individually gave potential cost-competitiveness with oil priced at $70/bbl to $120/bbl.

The cost competitiveness of ethanol is directly dependent on the price of oil and the realization of technological improvements. In particular, ethanol 'seed-to-station' floor cost is approximately $1.50/gal-ethanol without taxes, and gasoline will undercut this if priced below $2.25/gal-gasoline without taxes (about $2.65 at the pump). Government policy incentives such as carbon taxes, excise tax credits, and loan guarantees for cellulosic biofuels have the ability to mitigate the risk of oil market volatility, thus reducing the risk and increasing the attractiveness of cellulosic biofuels investments. However, these policy incentives would have to protect cellulosic biofuels against low priced petroleum-based competitors for an extended period to attract significant capital investment.

Continued support of R&D and initial commercialization is also critical, because sustained technological progress and commercial validation are required to affordably produce the large volumes of ethanol considered in this study. Infrastructure investment is important to ensure that the rail network in the U.S. can support biofuels distribution; however, this is a small component of projected total rail demands resulting from future expanded economic activity.

Significant R&D effort is required for conversion plants to increase their yields to drive down the cost of biofuel production. Additionally, continued R&D efforts are required to achieve commercial cultivation of high-yield energy crops – key to producing significant volumes of sustainable biofuels without drawing upon land currently used for food and feed. Additionally, expanding feedstock production must target lands requiring little or no irrigation to keep water demands manageable.

Transportation CO_2 savings were 250 million tons CO_2 equivalent per year for 60 billion gallons of ethanol (excluding greenhouse gas emissions from land use change – a current topic of intense research). The energy in cellulosic ethanol is about 3.8 times the energy content of fossil fuels used for the entire supply chain (production and distribution; numbers based, in part, on assumptions in GREET). This is about 4 times the net energy ratio for gasoline (0.8).

Biofuels Commercialization Enablers

This study found no fundamental barriers to producing biofuels at large scale (e.g., supply chain or water constraints). However, multiple actions could be taken to enhance the successful build-out of the cellulosic biofuels industry.

Possible actions include:

- A multi-decade energy policy that values stable fuel prices that are high enough to enable energy diversity in light of oil price volatility and periodic economic dislocations
    - Options include greenhouse gas taxes and market incentives (e.g., $50/ton CO_2 tax significantly reduces required incentives)
- Supportive policies to enable biofuel market success, including well-planned market incentives and carbon pricing, that could minimize investment risks
- Enhancement of biofuels' competitiveness with aggressive R&D- and commercialization-associated funding, despite current declining/low oil prices (Department of Energy, VCs, etc.)
    - Conversion investments to increase conversion efficiency and decrease capital cost
    - Improved energy crop technology to reduce cost, land use, and water use
    - Decreased timeframe for technologies to reach maturity (lowers investment risk)

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John B. Howe

John B. Howe is Vice President, Public Affairs for Verenium Corporation, a leading developer of cellulosic ethanol process technology and specialty enzymes. He joined the company in 2006 and is responsible for leading and coordinating the company's public policy advocacy efforts at the federal and state level. He represents Verenium in a variety of biofuels industry organizations.

Mr. Howe has over 25 years of career experience spanning several segments of the energy industry. Prior to joining Verenium, He served as Vice President, Electric Industry Affairs with American Superconductor, a developer of innovative power grid technologies. From 1995 to 1997, he served as Chairman of the Massachusetts Department of Public Utilities, where he spearheaded regulatory efforts to restructure the state's regulated energy industries to promote enhanced competition, customer choice and technology innovation. He held earlier positions with J. Makowski Associates, a large independent power developer; the U.S. Department of Energy; and the Alliance to Save Energy.

Mr. Howe is a board member and sits on the Executive Committee of the Renewable Fuels Association. In the past, he has held leadership positions in several national and regional groups representing energy-related industries and organizations, including the superconductor industry, state utility regulators, and the independent non-utility generating sector. He is a frequent speaker and published author on topics related to public policy reform and technology innovation in the energy industry. Mr. Howe holds a B.A in political science from Amherst College, *magna cum laude*, and a Master's Degree from the Fletcher School at Tufts University with a concentration in energy and resource economics. He was born in Boston and lives in Belmont, Massachusetts.